New Results for the ^{6}Li and ^{10}B Neutron Standard Cross Sections from R-matrix Analyses and Microscopic Calculations for the ^{7}Li and ^{11}B Systems

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As part of the IAEA-sponsored neutron standard cross section evaluation effort, we have undertaken new R-matrix analyses of reactions in the ^{7}Li and ^{11}B systems. The R-matrix parameters in these systems are compared with, and guided by, microscopic calculations that use semi-realistic nucleon-nucleon potentials in the Refined Resonating Group Model (RRGM).

The analyses include experimental data for all possible reactions open at excitation energies up to about 10.7 MeV in ^{7}Li, and up to about 12.8 MeV in ^{11}B. The effects of the three-body breakup channel, $n + d + \alpha$, appear to be important near the end of this range in the ^{7}Li system, and they are taken approximately into account. The fits to the data included are reasonable, although some of the $t + \alpha$ scattering measurements, in particular, have uncertainties that probably are too small. Measurements of the $^{6}\mathrm{Li}(n,t)^{4}\mathrm{He}$ angular distribution disagree substantially in the MeV neutron energy range where a number of overlapping resonances determine the shape of the integrated cross section. We will discuss the variances and covariances of these and other cross sections that result from the analyses.

In this mass range, computer-time limitations restrict the RRGM calculations to use semi-realistic $N-N$ forces, which can introduce artifacts associated with unphysical thresholds into the scattering calculations. However, by using non-orthogonal wave functions to determine the R-matrix poles and residues directly, these artifacts can be avoided. We compare first results of these calculations with the experimental parameters determined from the ^{7}Li and ^{11}B analyses.

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